HRVATSKO ASFALTERSKO DRUŠTVO

CROATIAN ASPHALT ASSOCIATION

OVERVIEW OF THE LATEST EUROBITUME LCA STUDY FOR BITUMEN

UVID U NAJNOVIJU EUROBITUME LCA STUDIJU ZA BITUMEN

MARKUS SPIEGL, OMV

9. MEĐUNARODNA KONFERENCIJA ASFALTNI KOLNICI 2025

9. INTERNATIONAL CONFERENCE ASPHALT PAVEMENTS 2025

OPATIJA 08. – 09. 05. 2025.

Eurobitume LCA Report 4.0

summary of the webinar content

from 12th and 26th March 2025

Presented as a member on behalf of Eurobitume

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January 2025 (31)

Core Members (18)

Continental Bitumen

GBS

International Members (1)

Société Multinationale de Bitumes

Associate Members (11)

Academia (1)

Life Cycle Assessment 4.0 for bitumen

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Background

- **Update the reference year of the data**
  - 1st LCI published in 1999
  - 2nd version published in 2012
  - **3rd version in 2020 (V3.0) / 2022 (V3.1)**

- Provide appropriate responses to the main **questions pointed out in the critical review** of the previous study (LCI 3.0/3.1)
  - Choice of database for raw data
  - Lack of primary data

→ 4th Life Cycle Assessment study (V4.0 - 2025)

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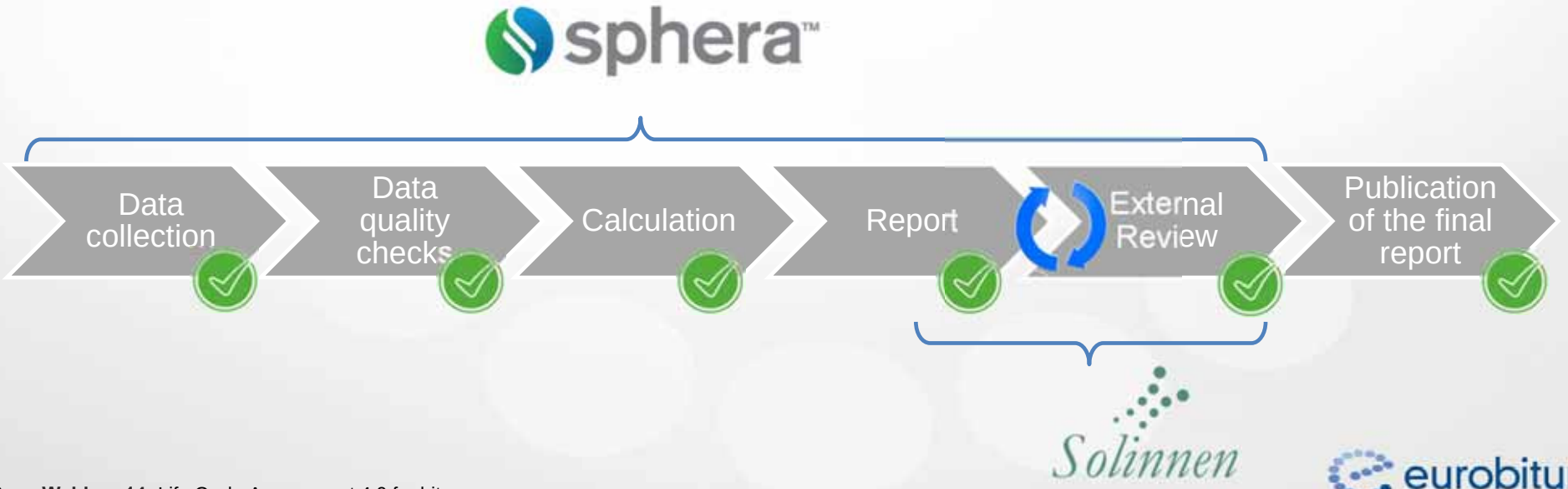
Framework

- **Carried out by recognised sustainability consulting company (Sphera)**
  - In accordance with the ISO 14040:2006 and ISO 14044:2006 standards
- **External critical review (Solinnen)**
  - in accordance with ISO 14071:2024 by an expert company



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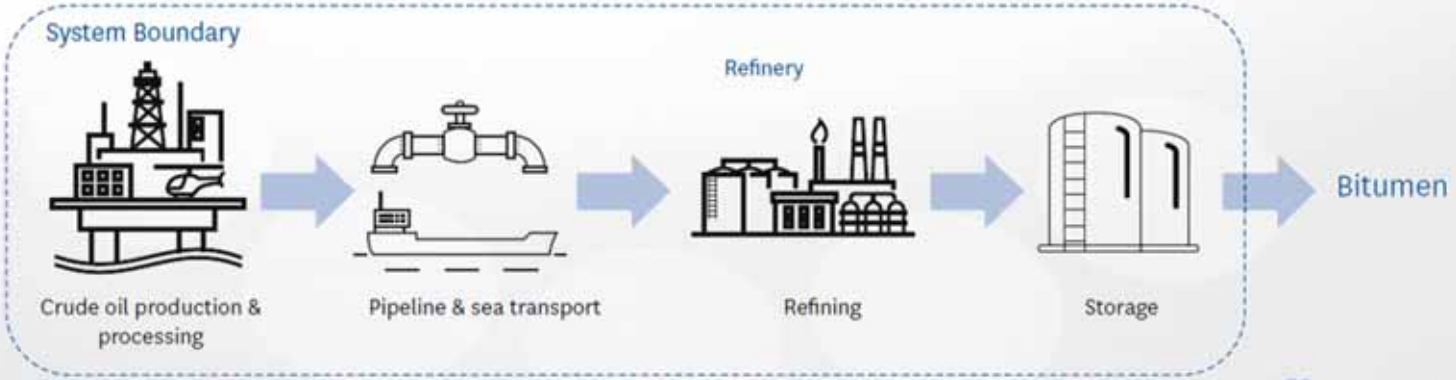
Scope of the study

- Reference unit: 1 t of bitumen / 1 t of oxidised bitumen
- Representative of bitumen production (Eurobitume members) in the EU & UK
  - Data collection from 17 refineries in Europe (8 companies) and estimated to represent ~75 % of the bitumen production of Eurobitume members
- System boundaries: cradle-to-gate, including crude oil production, crude transport and refining and storage at the refinery



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LCA 4.0 content

- Life Cycle Inventory (LCI)
  - Quantification of resources and emissions associated with the bitumen production
  - Complete dataset in ILCD format: can be used by LCA practitioners to conduct life cycle studies on products containing bitumen
- Life Cycle Impact Assessment (LCIA)
  - Impact categories in compliance with the standard EN 15804+A2 (38 indicators)
    - incl. **Global Warming Potential over a 100-year period (GWP_{100})**
    - Acidification
    - Eutrophication
    - Water use
    - Waste
    - Etc.

Cradle-to-gate LCI results of bitumen (in kg/t of bitumen)

Type	Flow	Bitumen (EN 12591) [kg/t]	Oxidised Bitumen [kg/t]
Resources	Water consumption	658	739
	Crude oil	994	1003
	Hard coal	2,21	2,77
	Lignite	2,19	3,05
	Natural gas	79,4	101,6
	Uranium	2,3E-04	3,5E-04
Emissions to air	CO_2	284	360
	CO_2 (biotic)	5,91	8,34
	CH_4	6,09	8,42
	CH_4 (biotic)	8,0E-02	8,7E-02
	N_2O	8,5E-03	1,0E-02
	NO_x	1,13	1,16
	SO_2	0,67	0,79
	NMVOC	1,65	1,74
	CO	0,34	0,38
	$PM_{2.5-10}$	8,2E-02	8,7E-02
	$PM_{2.5}$	1,1E-02	1,3E-02
	Heavy metals	2,7E-04	3,1E-04
Emissions to fresh water	Ammonia	9,9E-04	1,1E-03
	Nitrate	1,3E-02	1,5E-02
	Phosphate	7,4E-04	9,1E-04
	Heavy metals	1,5E-02	1,7E-02
Emissions to sea water	Ammonia	6,6E-07	1,4E-06
	Nitrate	4,6E-04	5,0E-04
	Phosphate	9,1E-05	1,6E-04
	Heavy metals	2,6E-03	2,7E-03

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LCA 4.0 content

- Life Cycle Inventory (LCI) of bitumen data set
  - Quantification of resources and emissions associated with the bitumen production
  - Complete dataset in ILCD format: can be used by LCA practitioners to conduct life cycle studies on products containing bitumen
- Life Cycle Impact Assessment (LCIA)
  - Impact categories in compliance with the standard EN 15804+A2 (38 indicators)
    - incl. **Global Warming Potential over a 100-year period (GWP_{100})**
    - Acidification
    - Eutrophication
    - Water use
    - Waste
    - Etc.

Core indicators (EN 15804+A2)

Impact category	Indicator	Unit (expressed per functional unit or per declared unit)
Climate change – total [a]	Global Warming Potential total (GWP-total)	kg CO_2 eq.
Climate change - fossil	Global Warming Potential fossil fuels (GWP-fossil)	kg CO_2 eq.
Climate change - biogenic	Global Warming Potential biogenic (GWP-biogenic)	kg CO_2 eq.
Climate change - land use and land use change [b]	Global Warming Potential land use and land use change (GWP-luluc)	kg CO_2 eq.
Ozone Depletion	Depletion potential of the stratospheric ozone layer (ODP)	kg CFC 11 eq.
Acidification	Acidification potential, Accumulated Exceedance (AP)	mol H^+ eq.
Eutrophication aquatic freshwater	Eutrophication potential, fraction of nutrients reaching freshwater end compartment (EP-freshwater)	kg PO_4 eq.
Eutrophication aquatic marine	Eutrophication potential, fraction of nutrients reaching marine end compartment (EP-marine)	kg N eq.
Eutrophication terrestrial	Eutrophication potential, Accumulated Exceedance (EP-terrestrial)	mol N eq.
Photochemical ozone formation	Formation potential of tropospheric ozone (POCP)	kg NMVOC eq.
Depletion of abiotic resources - minerals and metals [c] [d]	Abiotic depletion potential for non-fossil resources (ADP-minerals&metals)	kg Sb eq.
Depletion of abiotic resources - fossil fuels [c]	Abiotic depletion for fossil resources potential (ADP-fossil)	MJ, net calorific value
Water use	Water (user) deprivation potential, deprivation-weighted water consumption (WDP)	m^3 world eq. deprived

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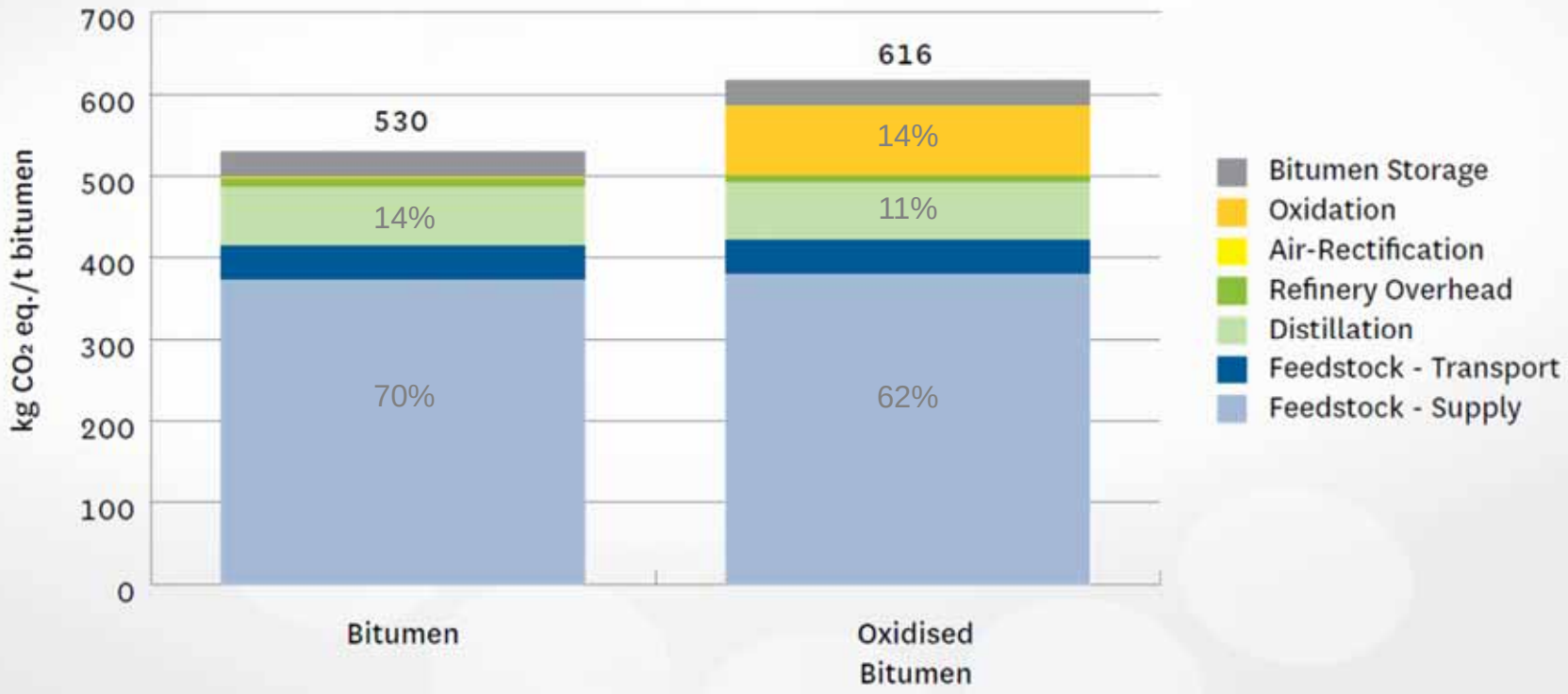
GWP_{100} indicator (AR6*) – Results



* 6th Assessment Report (IPCC, 2022)

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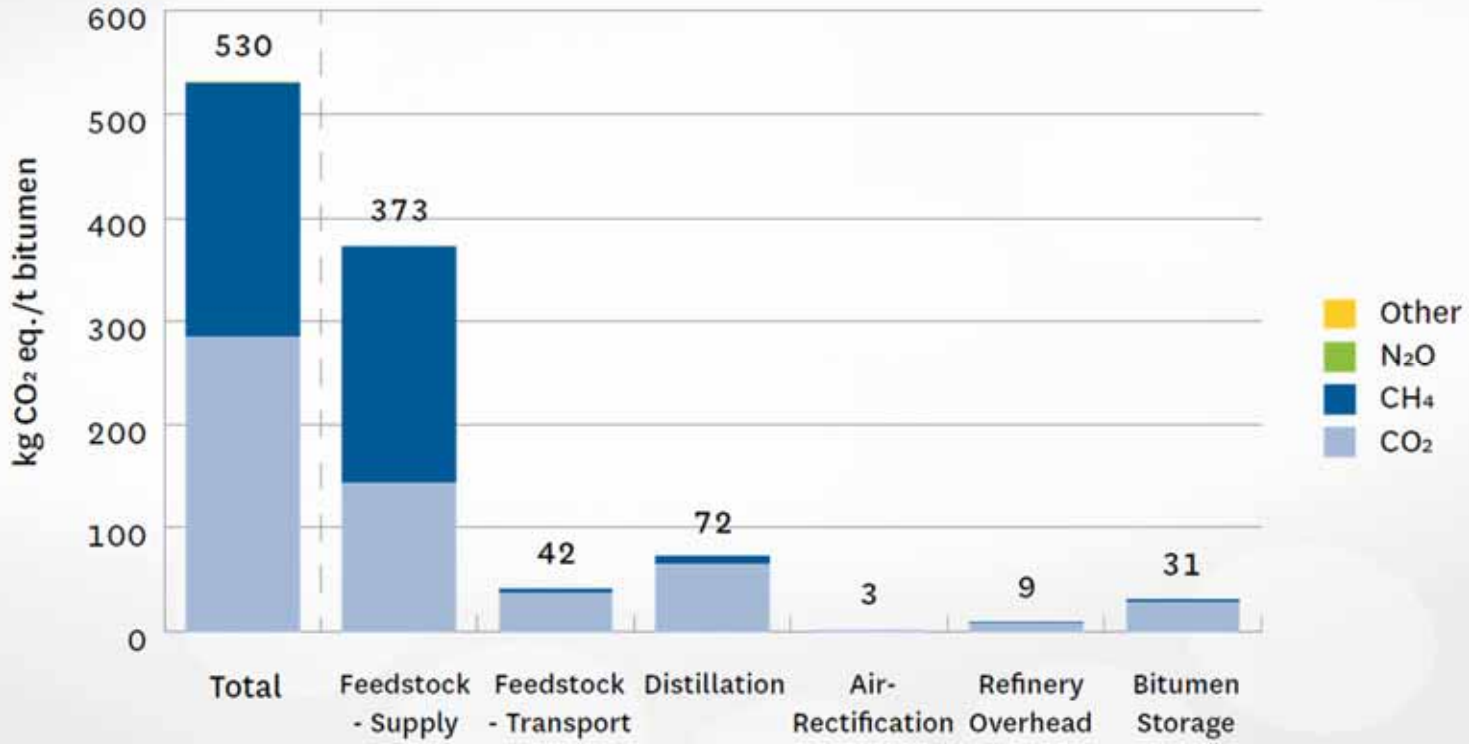
Individual GHGs for bitumen GWP_{100} (AR6*) per process stage



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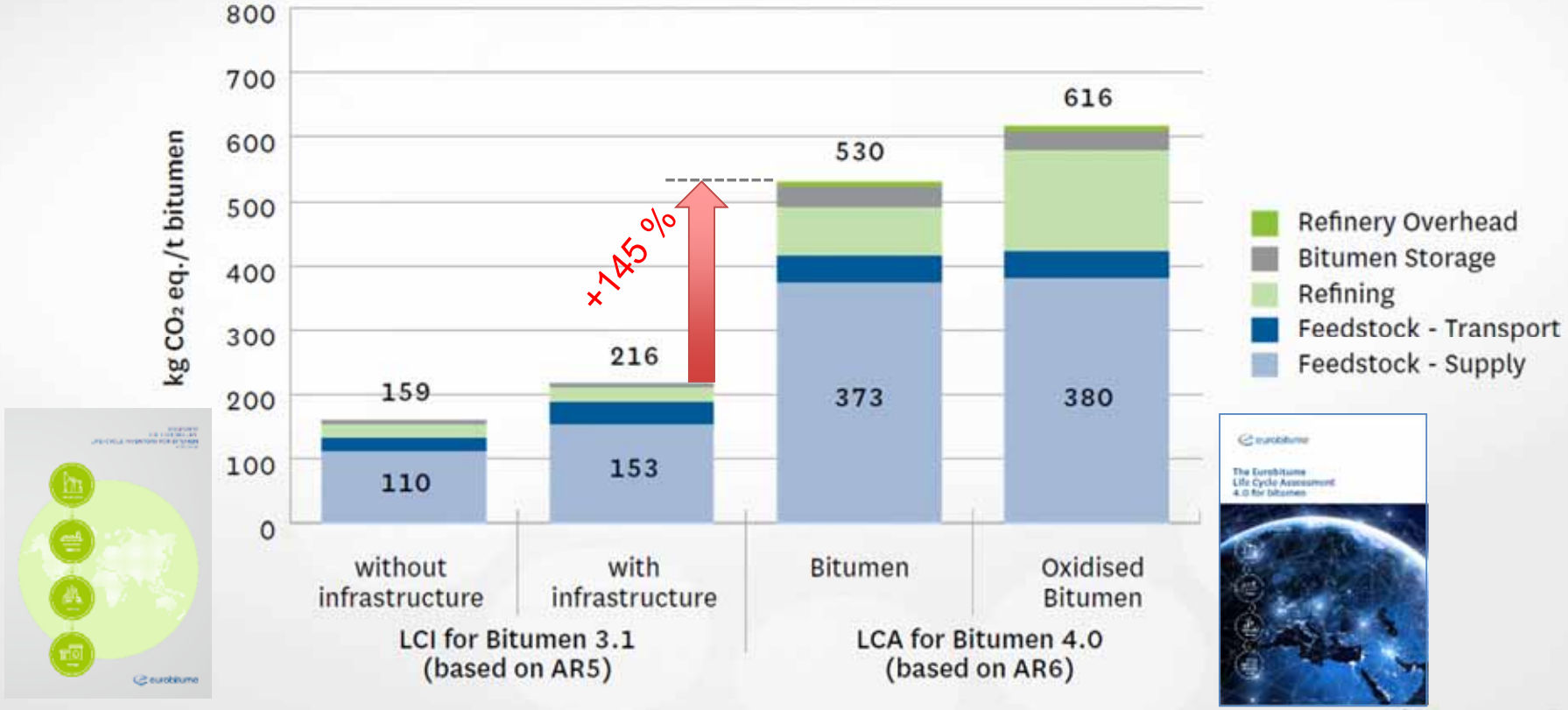
GWP_{100} LCI 3.1 vs. LCA 4.0



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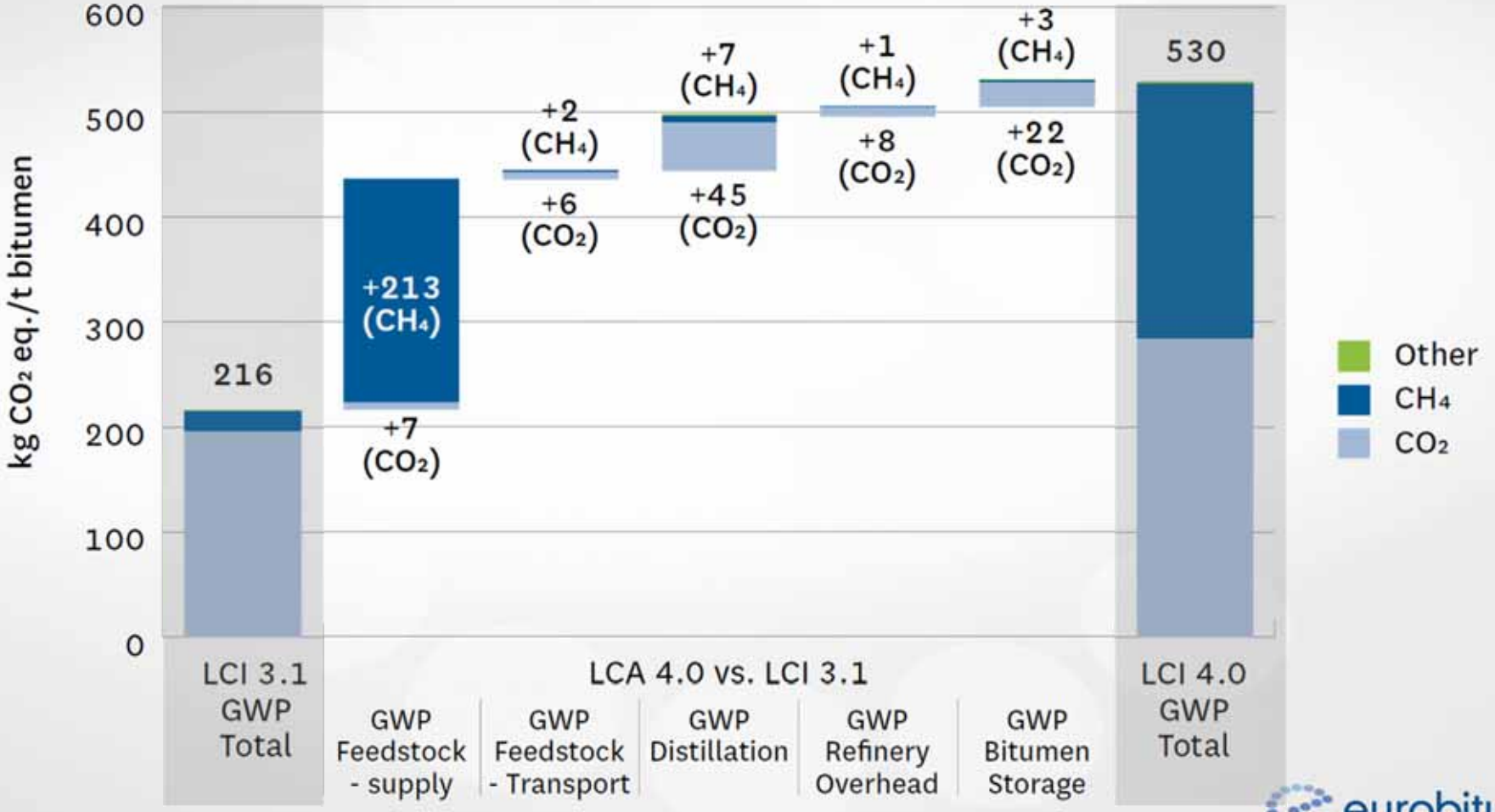
LCA Methodology – V3.1 vs. V4.0

	LCI 3.1 (2020 + 2022 update)	LCA 4.0 (2025)
Crude oil database	• Energy consumption / emission: IOGP per region/continent and combined with Ecoinvent background LCI data • 5-year rolling average for crude oil extraction (2015-2019)	• Sphera's Managed LCA Content (MLC) 2024.1 database / Averaging by country of origin • Venting, flaring and fugitives based on the IEA “Global Methane Tracker” tool
Crude oil basket	• Crude mix used for bitumen production estimated by Eurobitume members (reference year 2019)	• Refinery specific crude supply data by country of origin collected and weighted by individual refinery bitumen production • Feedstock supply referring to a 3-year average (2021-2023)

LCA Methodology – V3.1 vs. V4.0

	LCI 3.1 (2020 + 2022 update)	LCA 4.0 (2025)
Allocation method at the refinery	• Sensible heat method: energy to heat the bitumen fraction from the crude oil to the run-down temperature • Refinery energy grid based on primary data from Eurobitume members	• Allocation by energy for the distillation steps based on the primary data of 17 refineries
Bitumen Storage	• Energy consumption was calculated based on literature and defined storage parameters	• Based on primary data

LCI 3.1 vs. LCA 4.0 – Synthesis



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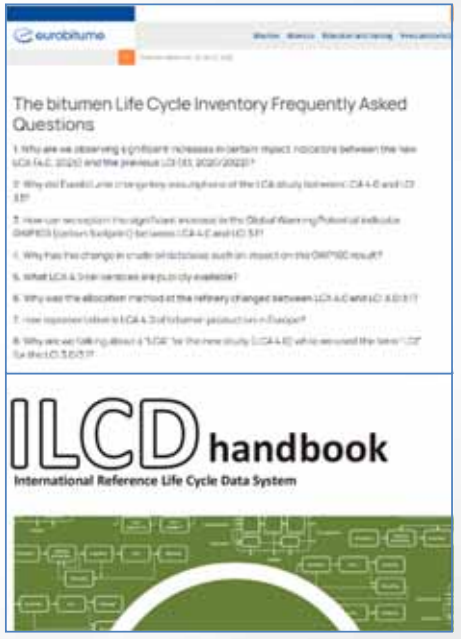
Deliverables available on the Eurobitume website

LCA report including

- LCI (Life Cycle inventory)
- LCIA (Life Cycle Impact Assessment)
- Critical review (external verification)

Summary and comparative analysis with LCI 3.1

Focused on the Global Warming Potential indicator (GWP_{100})



LCI in the ILCD format

Frequently Asked Questions

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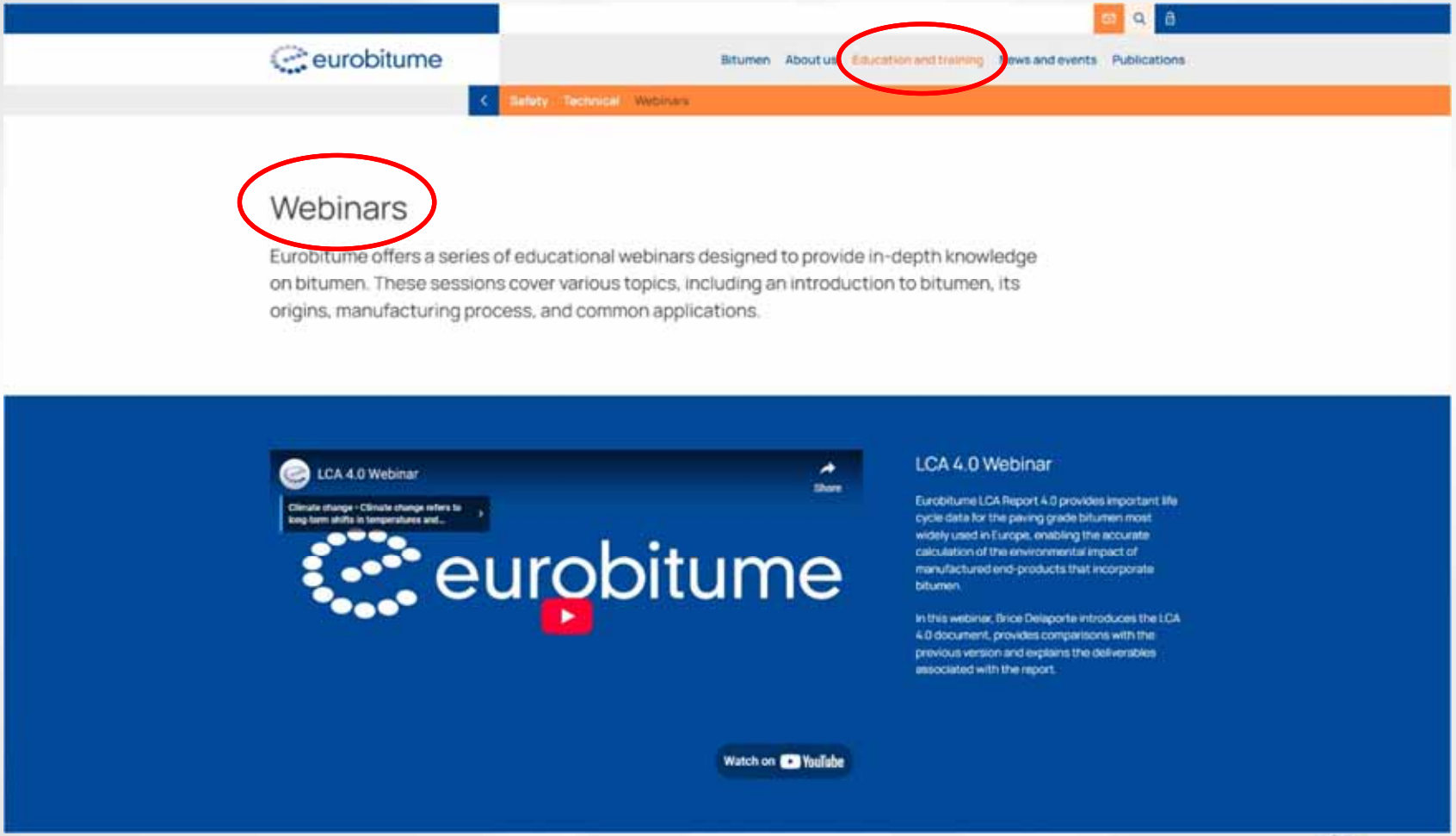
EB Website



www.eurobitume.eu

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QUESTIONS AND MORE INFORMATION

PLEASE CONTACT :

BRICE DELAPORTE (EB SUSTAINABILITY LEAD)

Email: Brice.Delaporte@eurobitume.eu

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Many thanks!

markus.spiegl@omv.com
+43 664 3518031

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